# AMNIOTIC FLUID INDEX - A NEW ULTRASOUND ASSESSMENT OF AMNIOTIC FLUID VOLUME : AN ADJUNCT IN ANTEPARTUM FOETAL SURVEILLANCE.

## THESIS

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ANJNA AGRAWAL

# C E R T I F I C A T E

This is to certify that the work entitled "AMNIOTIC FLUID INDEX - A NEW ULTRASOUND ASSESSMENT OF AMNIOTIC FLUID : AN ADJUNCT IN ANTEPARTUM FOETAL SURVEILLANCE" which is submitted as a thesis for M.S.(Obstetrics and Gynaecology) by Dr. Anjna Agrawal, has been carried out under my direct supervision and guidance in the department of Obstetrics and Gynaecology M.L.B. Medical College, Jhansi.

She has put in the necessary stay in the department as per university regulations.

Dated:

( Mridula Kapoor )
M.S.,
Associate Professor & Head,
Department of Obstetrics &
Gynaecology,
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JHANSI.

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Dated:

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M.S.,
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Dated:

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Dated: 30-11-92

Anjna Agrawal

(Anjna Agrawal )

## ABBREVIATIONS USED

AFI = Amniotic fluid index.

AFV = Amniotic fluid volume.

cm. = Centimeter.

FHR = Foetal heart rate.

NST = Non stress test.

IUGR = Intra uterine growth retardation.

IUD = Intra uterine death.

USG = Ultra sonography.

$\angle$ = Less than

$\rangle$ = More than

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# I N T R O D U C T I O N

# INTRODUCTION

For decades amniotic fluid volume has been known to play a significant role in obstetrical management for timely delivery and subsequent foetal outcome. Sonographic estimation of amniotic fluid volume is commonly used as a diagnostic method for oligohydroamnios. Ultrasound technique being non-invasive; is very safe and effective investigation in antenatal period and has come up one of the principle means to study antepartum foetal surveillance.

Normal amniotic fluid volume at term is 300-1200 ml and amount less than 100 ml is termed as oligohydroamnios and amount greater than 2000 ml as polyhydroamnios. The association between abnormalities of amniotic fluid volume and altered perinatal outcome has long been recognised.

Antenatal recognition of oligohydroamnios has traditionally been based on clinical examination of the patient which is exceedingly difficult and frequently inaccurate. A symphysis fundal height either less than or greater than expected for gestational age should alert the clinician to the possibility of amniotic fluid volume abnormality. More reliable methods for detecting oligo and poly-hydroamnios are Radiography (plain X-ray

abdomen, amniography) and sonography (measurement of total intrauterine volume) techniques. The result of these methods which are either invasive or time consuming or both, have been disappointing and a simple, clinically applicable and reliable method for assessing amniotic fluid volume is needed.

Recently ultrasonographic visualization of amniotic fluid has given rise to both subjective and semiquantitative method of fluid estimation. Oligohydroamnios is noticed by very little fluid surrounding the foetus(thus difficulty in defining the foetal boundaries as foetal abdominal circumference) is subjective method (Hadlock). Semiquantitative approach typically estimate amniotic fluid volume by measurement of depth or width of the largest clear amniotic fluid pocket, as reported by many authors (Bastide et al, Manning et al, 1981; Chamberlain et al, 1981 and Philipson et al, 1983). However, methods of measurement and diagnostic criteria are controversial.

Phelan et al (1987) introduced four quadrant technique as amniotic fluid index for assessment of amniotic fluid volume. This thesis work has incorporated similar technique as by Phelan, to study amniotic fluid index to assess amniotic fluid volume.

The use of ultrasound in antepartum foetal surveillance has allowed a more complete evaluation of the foetus and its intrauterine environment. A markedly diminished amniotic fluid volume has been accepted as abnormal biophysical profile. In our study oligohydroamnios is correlated with foetal heart rate in predicting the perinatal outcome. In this study we found out that amniotic fluid index method is a reliable technique to evaluate the amniotic fluid volume and correlating with the foetal outcome.

## AIMS OF THE STUDY

This study was done with the following aims :-

1. To evaluate the normal range of amniotic fluid index in term pregnancy.
2. To find out oligohydroamnios cases and to correlate it with foetal heart rate and foetal surveillance perinatally and the mode of delivery.
3. To study the amniotic fluid index in IUGR and postdated pregnancy.

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# REVIEW OF LITERATURE

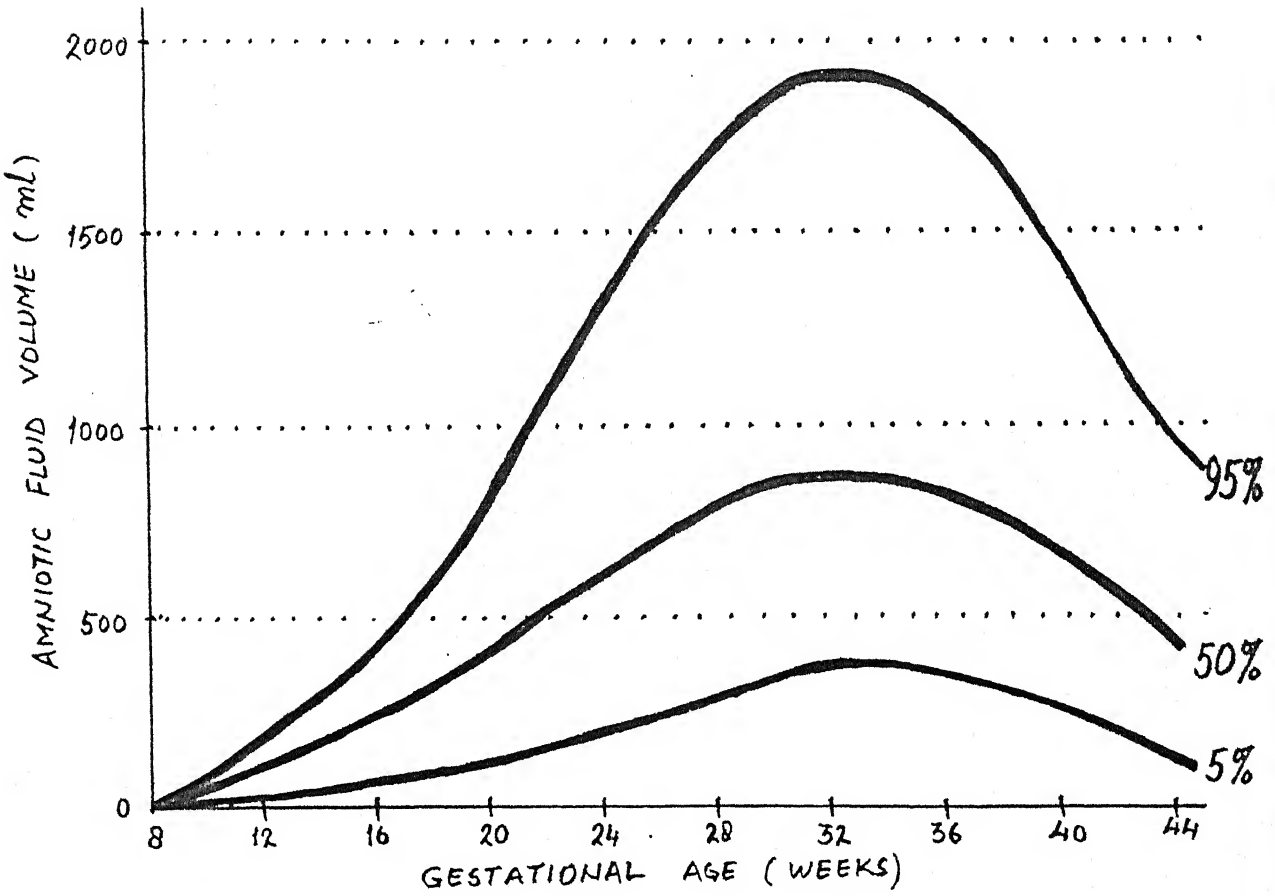
# REVIEW OF LITERATURE

## 1. AMNIOTIC FLUID VOLUME

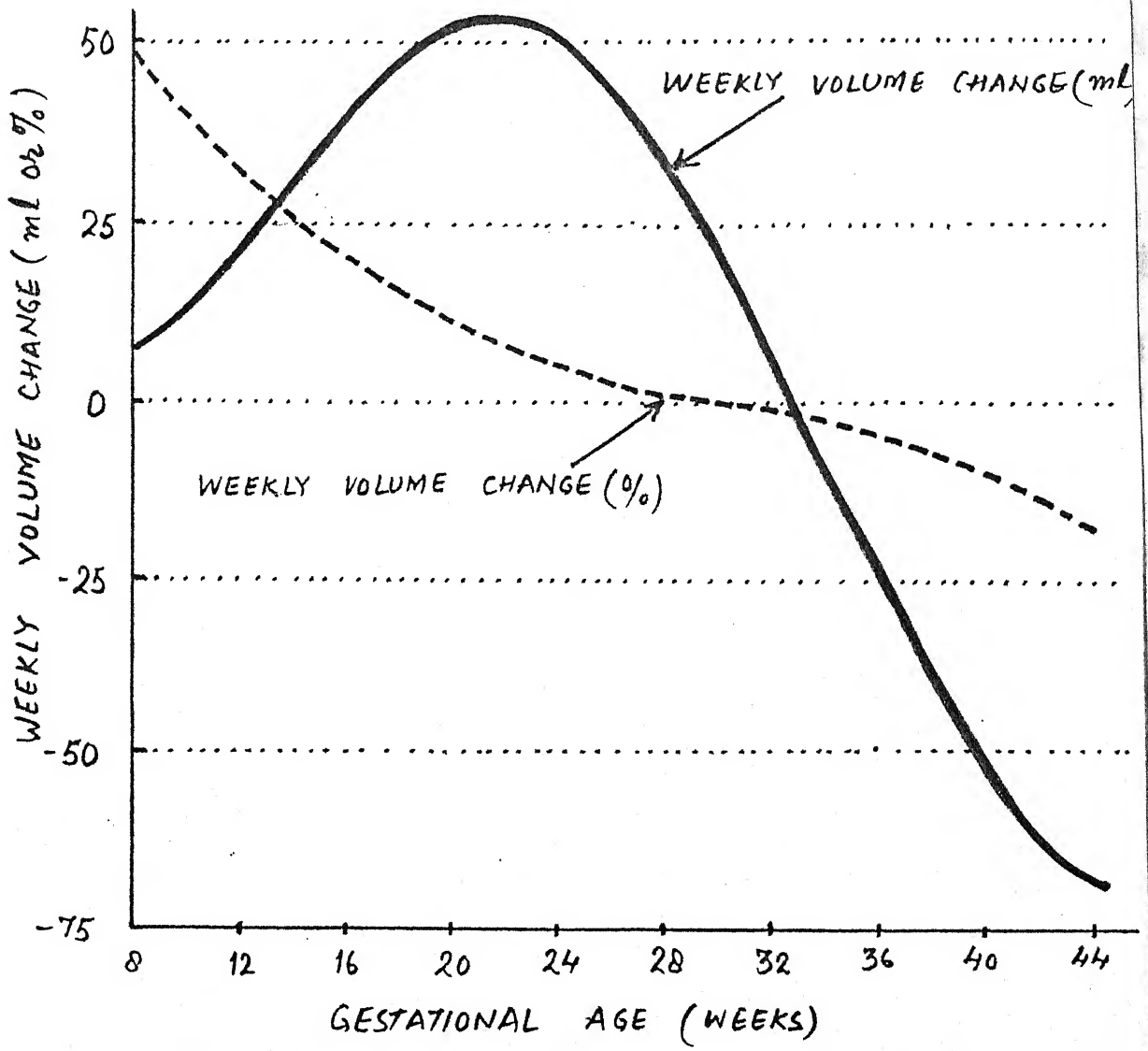
Amniotic fluid is increased rapidly to an average volume of 50 ml at 12 weeks gestation and 400 ml at mid pregnancy. It reaches a maximum of about 1000 ml at 36 weeks to 38 weeks of gestation. Then the volume decreases as term approaches and if the pregnancy is prolonged, amniotic fluid may become relatively scanty. There are rather marked individual differences in amniotic fluid volume however as reported by Fuchs (1962).

Gadd (1966) reported majority of values for normal pregnancy lay between 500 ml to 1,100 ml from 30th to 37th week and then fell to between zero and 600 at 43rd week.

The mean change in amniotic fluid volume was calculated on weekly basis. Robert, A brace and Edward, J Wolf (1989) reported mean amniotic fluid volume is increasing 45% per week at 8 weeks, 25% per week at 15 weeks, 10% per weeks at 24 weeks and 0% at 33 weeks. At 40 weeks, volume is decreasing an average of 8% per week.




Graph : Nomogram shows Amniotic fluid volumes with gestational age on a linear scale (Robert A, Brace, Edward J Wolf, 1989).




Graph : Weekly changes in mean amniotic fluid volume as calculated from polynomial regression equation.(Robert A. Brace, Edward J Wolf, 1989).

## 2. AMNIOTIC FLUID DYNAMICS

A number of hypotheses were suggested in past years to explain amniotic fluid formation and regulation.

### i) Secretion of water or Amniotic Fluid by Amniotic epithelium or chorionic Laeve (Seeds AE, 1980).

Amniotic fluid in early pregnancy is a product primarily of the amniotic membrane covering the placenta and cord. As pregnancy advances the surface of the amnion expands and the volume of fluid increases.

There is no evidence for the active transport of water across these tissue layers. Water crosses these membranes only in response to a chemical potential gradient, osmotic or hydrostatic. If a net movement of water should take place across the amnion and chorion laeve in the third trimester, it would occur by a passive transport or by osmosis from the amniotic sac to the maternal compartment, mediated by the chemical potential gradient between hypotonic amniotic fluid and isotonic maternal fluid.

### ii) Transfer of water between Amniotic fluid and Foetal vessels in the Umbilical cord

Again water can only cross the exchange surface between the large vessels and the amniotic cavity in response to chemical potential gradients.

Although the isotonic foetal plasma can be expected to reabsorb some water from the hypotonic amniotic fluid, infact the very small ratio of the vessel wall surface area to the flow provided by large vessels makes this a totally ineffective exchange site compared to the favourable large ratio of surface area to vessel flow found in capillary bed. It, thus, seems impossible for any sizeable exchange of water or solute to occur between foetus and amniotic fluid by this pathway.

iii) Basic Biological Mechanism Involved in Water Transfer

Water mixes across body membranes in response to hydrostatic or osmotic gradient bulk flow. In presence of such gradient water moves across multicellular porus tissues layers such as amnion and chorion by a non diffusional process known as bulk flow. The rate of water transfer is accelerated when movement occurs in bulk or solvent form in response to chemical potential gradient. The passive movement of water molecules becomes augmented when the membrane contains pores or channels.

Leaky or Partially Semipermeable Membrane

Amniotic and chorionic tissues are highly permeable to water. Many small compounds readily diffuse across corion and amnion but still exert some

small osmatic force. In this case, placental tissue does not discriminate perfectly between solute and solvent but is partially permeable or leaky to smaller solute molecules. These solute may diffuse across the placenta in large amounts, however, since they do not cross as rapidly as water, they still exert some small osmotic force.

iv) Exchange of Amniotic Fluid solute and water with Adjacent Compartments

There is a strong evidence for significant exchange of water and solute amniotic fluid and foetal compartments through out pregnancy.

Amniotic fluid become moderately hypotonic near term and is thought to be the product of numerous exchanges with the foetus. The human foetus is estimated to produce 600-800 ml per day of very hypotonic urine at term. Foetal urine is hypotonic in comparison to maternal and foetal plasma but it contains more urea, creatinine and uric acid than does plasma. The net effect is that the osmolality of fluid decreases with increasing age of gestation. The foetus swallow between 200-450 ml of amniotic fluid per day by which about only half of the urine and urine products are removed, whenever foetal swallowing is greatly impaired, a great excess of amniotic fluid develops (hydroamnios) conversely when urination in

utero cannot take place, as in the instances of renal agenesis or atresia of urethra. This volume of amniotic fluid surrounding the foetus is limited (oligohydroamnios).

Since foetal plasma is significantly hypertonic to amniotic fluid a sizeable net transfer of fluid from amniotic to the foetal compartments would result whenever a foetal capillary bed is in proximity of this fluid.

Recent studies by Duenhoelter and Pritchard have indicated a sizeable steady rate in and out amniotic fluid through the foetus lungs in response to active respiratory movement in the 3rd trimester. This process would presumably introduce hypotonic amniotic fluid to a large alveolar capillary bed surface area and a daily net reabsorption of fluid could be expected to take place.

The large foetal skin capillary bed may serve as a site for amniotic water and solute exchange in early pregnancy, but after keratinization of this layer at about 24-28 weeks gestational age, this tissue become very impermeable. Keratinized skin may remain partially permeable to small highly lipid soluble compounds such as carbondioxide and oxygen.

An additional site for possible exchange of water and solute between amniotic fluid and foetus would

be accross the foetal surface of the discord placental that is across the amnion and chorionic plate from the placental capillary bed. Abramovich and Page (1970) have shown that water, sodium, chloride, urea and creatinine readily cross this exchange surface.

Prolactin has been reported in preliminary studies to reduce the permeability of human amnion. These findings together with a significant reduction in normally very high amniotic fluid prolactin values associated with hydroasmnios have resulted in speculations that prolactin may be active in regulation of human amniotic fluid volume and composition.

The evidences presented suggested that foetal swallowing and voiding play a small part in the control of amniotic fluid volume. There is also a dynamic interchange of water and electrolyte between the feto-placental unit and mother which undoubtedly plays a role in the control of amniotic fluid volume(Abramovich, 1970).

VARIOUS METHODS OF AMNIOTIC FLUID VOLUME DETERMINATION

1. Abdominal Palpation

   (Clinical signs of oligohydroamnios)

   - Size of uterus less than period of gestation.
   - Poor fluid foetal interface.

- Marked crowding of foetal small parts.
- Easily palpable foetal parts (Philipson et al, 1983).

2. Direct Measurement

The method used for estimation of volume of liquor in late pregnancy have varied from crude direct method (Fehling, 1879) to weighing the patients before and after delivery and deducting the weight of foetus and placenta from the difference (Gassner, 1862; Lehn, 1916) or collecting liquor at caessarian section in measuring cylinder (Guttmann and May, 1930) and adding arbitrary 300 ml for the amount lost during collection (Cox and Chalmer, 1953).

In early pregnancy a direct method was used on fresh specimen obtained at abdominal hysterectomy or complete abortion. Amniotic fluid volume was determined from gestational sac (Harrison and Malpas, 1953; Monie, 1953; Wagner and Fuchs, 1962).

In the last trimester, knowledge of volume has been based on clinical bed side impression (Macafee, 1950), some times confirmed by measurement of the liquor escaping from the uterus on artificial rupture of the membranes (Scott and Wilson, 1957).

3. Dye Dilution Technique

In 1933 Dieckmann and Davis of Chicago

introduced a new method of estimating the volume without disturbing the pregnancy as dye dilution technique. Different dyes were used in different studies as Congo-red (Dieckmann and Davis, 1933; Dennis and Cheyne,1964), Inulin (Lambiotte and Rosa, 1949), Evans blue (Nelson et al, 1954), Deutrium oxide, radio active iodinated serum albumin (RISA), (Nelson et al, 1954). Coomassie blue (Elliott and Inman, 1961; David and Peter, 1966) and Paraamnio hippurate (PAH) (Queenan et al, 1972).

John T. Queenan et al (1972) have done amniotic fluid volume estimation using para amino hippurate. Transabdominal aminocentesis was performed with a 20 gauze stellated needle PAH in a measured dose of 200-400 mg was injected. The patient was ambulated to encourage amniotic fluid mixing. After 20-30 minutes, second aminocentesis was performed and amniotic fluid sample withdrawn. This fluid was centrifuged for 10 minutes at 3000 revolutions per minute and the concentration of PAH was determined by diazoreaction method. Queenan et al (1972) found a method to provide reproducible results with less than 8 percent error.

4. Amniography

Water soluble radio opaque dye like urograffin or hypaque injected into the amniotic sac. X-ray scan reveal roughly the amount of amniotic fluid.

5. Ultrasound Determination of Amniotic Fluid Volume

In 1942 Dussik was the first person who made an attempt at visualising structures using a technique based on the principles of echo-sounding.

Estimation of total intrauterine volume(TIUV) was developed by Gohari et al (1977). This technique was used to assess the amniotic fluid volume and to predict intrauterine growth retardation. Total intrauterine volume was determined by taking sagittal and transverse echograms of pregnant uterus. Gohari et al (1977) found direct relationship between placental size and IUGR and that the condition is almost always associated with oligohydroamnios.

Volume = 0.5233 x longitudinal diameter
X transverse diameter X Ant Post diameter.

By this method 75% cases of IUGR were detected by single examination. Chinn and Associates (1981) showed that the positive predictive value of total intrauterine volume was poor. Grossman and associates (1982) questioned the reproducibility on the measurement basis that appropriate landmarks were difficult to identify and varied relative to bladder filling.

However, with the development of real time ultrasound, newer techniques were saught. Initially the qualitative amniotic fluid volume assessment was

used to predict intrauterine growth retardation and oligohydroamnios.

A. MAXIMUM VERTICAL POCKET METHOD

Manning et al (1980) observed amniotic fluid volume by linear array ultrasound method in patients reffered with a diagnosis of intrauterine growth retardation. In their study largest pocket of amniotic fluid was measured in its vertical diameter or broadest diameter and qualitative AFV was coded normal if any pocket exceeded 1 cm in broadest diameter. With a q AFV less than 1 cm incidence of IUGR was 89.9%. Manning, Platt and Sipon (1980) included this criteria of less than 1 cm in biophysical profile along with other biophysical variables like foetal breathing movements, foetal tone, non stress test and foetal movements.

Hoddick et al (1984) suggested by their study that if this rigid criteria had been applied for detection of IUGR, it is highly under diagnosed. Determination of IUGR was falsely negative in 96% of cases. In prolonged pregnancy less than one cm rule was significantly associated with perinatal morbidity (Leveno et al, 1984). Phelan et al (1985) and Eden et al did find that q AFV technique could reliably predict oligohydroamnios, but definition was too restrictive.

Chamberlain et al (1984) described the maximum depth of amniotic fluid pocket as

< 1 cm - decreased amniotic fluid volume

1 - 2 cm - marginal

2 - 8 cm - normal group.

Patient with largest pocket of amniotic fluid of < 2 cm should be investigated intensively to ascertain early delivery might be indicated.

Patricia Crowley et al (1984) diagnosed reduced amniotic fluid volume when no single vertical pool of amniotic fluid measured more than 3 cm. Pockets of amniotic fluid were usually found around foetal limbs or nuchal area. Patient with reduced amniotic fluid had a statistically significant increase in meconium stained amniotic fluid and growth retardation with increased incidence of caesarian section.

In a study done by Robert M. Patterson (1987) to evaluate the reproducibility of amniotic fluid measurement, maximum vertical pocket was compared to an average of three diameters of the largest pocket of amniotic fluid. In this study the vertical and two perpendicular horizontal diameters of the largest pocket of amniotic fluid that was free of umbilical cord and extremities was measured and averaged.

B. AMNIOTIC FLUID INDEX

Phelan (1987) described the amniotic fluid assessment with the four quadrant technique, which provide a more representative image of the intrauterine content. The uterine cavity was divided into four quadrants. With the use of linear array, real time B scanning, the vertical diameter of the largest pocket in each quadrant was measured. The sum of these four quadrants was used to provide a single number for the amniotic fluid volume are termed the amniotic fluid index. This approach is simple, requires little time and gives a semiquantitative estimate of amniotic fluid volume. Based on their observations, the normal amniotic fluid index in term gestation is 12.9±4.6 cm.

Amniotic fluid index rises progressively from 11th to 26th weeks. Thereafter until term AFI remains approximately 16.2±5.3 cm. After 38 weeks the AFI appeared to decline gradually. Thus serial measurement of amniotic fluid index may be effective means of assessing foetal status throughout pregnancy (Phelan, Smith, Rutherford et al, 1987).

Thomas R. Moore and Cayle (1990) provided normative data for amniotic fluid index through out the pregnancy. Amniotic fluid index curve showed that AFI decreases by approximately 12% per week in post date period.

Amniotic fluid index was evaluated in relation to foetal heart rate, and perinatal morbidity and an inverse relationship was found between the amniotic fluid index and NST, FHR decelerations, meconium staining, caessarian section for foetal distress and low Apgar scores. Adverse perinatal outcome was significantly more frequently with diminished compared with normal amniotic fluid volume, even if the NST was reactive (Phelan, 1987).

Rutherford et al (1987) have suggested a 5 cm rule as the lower limit for the acceptability for the amniotic fluid index in term gestation, because there is significant morbidity in pregnancies with AFI less than 5 cm., - Moore (1990) took this 'Alarm point' as 5th percentile value of amniotic fluid index for the detection of oligohydroamnios. Grubb and Paul (1992) reported that women with amniotic fluid index less than 2 cm had 64% operative interference, compared to 21% who had index of 2 cm or more.

Phelan (1991) reported that AFI less than 5 cm during intrapartum period is also related with increased perinatal morbidity even if the membranes had been ruptured in early labour.

OLIGOHYDROAMNIOS

The volume or amniotic fluid may fall far below the normal limits and occasionally be reduced to only few ml of viscid fluid. This is a clinical hall mark of impending severe perinatal compromise. The risk of cord compression and foetal distress in them is increased as the consequence of scanty volume of fluid.

Oligohydroamnios is practically always evident when there is either obstruction of the foetal urinary tract or renal agenesis. A chronic leak from a defect in membranes may reduce the volume of amniotic fluid appreciably. Oligohydroamnios is found in common association with intrauterine growth retardation and post dates.

When amniotic fluid is scanty, pulmonary hypoplasia is very common. Normal infants may suffer the consequences of severely diminished amniotic fluid, since severe deformities including amputation, musculoskeletal deformities like club foot, torticollis are frequently observed. Skin of the foetus typically appears dry, leathery and wrinkled.

This leads to prolonged labour due to uterine inertia and mal presentation. Thus both foetal and maternal distress are common during labour. It is advisable to terminate pregnancy within 48 hours in cases of severe oligohydroamnios unless extreme prematurity.

INTRAUTERINE GROWTH RETARDATION

IUGR is defined as birth weight more than 2 SD below the mean birth weight for that gestational age (Usher et al, 1969). Birth weight criteria as less than 2.51 kg does not necessarily imply IUGR as it does not take gestational age in account.

Among all IUGR fetuses 2/3rd comes from high risk group and 1/3rd from patients with no high risk factor. Hence all fetuses should be analysed for IUGR in all obstetrical sonograms regardless of reason of study. Detection of IUGR by clinical means alone is difficult and subjected to a wide range of errors. Diako (1979) reported that maternal weight gain less than 2 pounds per week was noted in 64% of IUGR but also noted in 36% of normal pregnancies. Fundal growth less than 2 cm/week was present in 64% of IUGR cases but also present in 25% cases of normal growth pregnancies.

Estriol estimation in maternal serum and urine is also of limited value low estriol/creatinine ratio was found to be better indices for the diagnosis of IUGR ( Daiko, 1979).

By ultrasound foetal growth is assessed by serial estimation of biparietal diameter, head circumference, Abdominal circumference, femur length, approximate weight estimation. IUGR can better be detected by combined measurements and body proportions like head

circumference/abd.circumference; femur length and abdominal circumference ratio and total intrauterine volume (Hadlock et al, 1983).

A reduction of amniotic fluid is a common finding in pregnancies affected by IUGR. Manning(1981) and Seeds (1984) suggested using an estimate of amniotic fluid volume as a screening for IUGR. They observed that largest pocket of amniotic fluid less than 1 cm gave high probability (89.9%) of the foetus being growth retarded. Philipson et al (1983) reported that chance for IUGR increases 4 fold in oligohydroamnios.

Several large studies have established that IUGR babies have a 3-10 fold increase in perinatal mortality. IUGR babies are subjected to numerous problems during the immediate post partum period such as intrapartum asphyxia, neonatal hypoglycemia acidosis, hypocalcemia, polycythemia. For these measures, it is imperative that the diagnosis should be made earlier and timely decision for termination of pregnancy should be taken.

POST DATED PREGNANCY

Any pregnancy running over the expected date of delivery is termed as post dated pregnancy. Post maturity criteria were given by finn and Boe (1950) as :

i) Pregnancy of more than 290 days.

ii) Baby weight more than 4.0 kg.

iii) Height of fetus more than 54 cm.

Any 2 criteria should be present to diagnose the case as postmature.

The effect of deprivation on the fetus vary with the duration and have been divided into 3 phases (Peter G, 1964).

i) Acute perinatal distress with a duration of a few hours before birth is usually related to the effect of labour and delivery in previously compromised fetus.

ii) Subacute fetal distress lasts days and results in wasting and often meconium staining most of the deprivations in prolonged pregnancy belong to this category.

iii) Chronic fetal distress extends over weeks of intrauterine life and results in IUGR.

As pregnancy extends postterm, incidence of placental insufficiency, fetal dysmaturity and fetal perinatal mortality and morbidity increased rapidly as a consequence of reduced respiratory and nutritive placental function and despite a compensatory fetoplacental respiratory reserve capacity. Fetal distress is observed in about 1/3rd of post term pregnancies(Helmuth Vorherr, 1975).

Ultrasound is a very effective mean for the diagnosis of postmaturity and for antepartum fetal

surveillance. Leveno et al (1984) reported increased incidence of fetal distress and caessarian sections with oligoamnios as this typically leads to umbilical cord compression. Crowley (1984) also reported increased incidence of caessarian section in prolonged pregnancy with reduced amniotic fluid volume. There was a significant increase in the incidence of grade II and III meconium. Caesarian rate was 43% in oligoamnios group in comparison to 16% of normal group in study of Phelan (1985). Oligohydroamnios was very common (81.8%) among postmature pregnancies and it was associated with grade II and III placenta (Fernando, 1985). Presence of immature placenta is rare after 42 weeks and placental grading can not be used to predict postmaturity.

Grubb et al (1992) reviewed post term gestation twice weekly by NST and AFI and estimated the risk of fetal death in an expectant post term pregnancy.

Timing of delivery of the post term gestation balances the risk of loss of a viable fetus with risk of uncertain dating and failure of induction. He reported mean amniotic index as 9.1 in post term pregnancy. Grubb et al (1992) reported 64% caesarian section rate in cases with AFI $\angle$2 cm and only 21% caesarian rate with $\geq$2 cm AFI.

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# MATERIAL AND METHODS

# MATERIAL AND METHODS

The study was conducted on 70 pregnant women which were selected randomly from the antenatal clinic and maternity ward of M.L.B. Medical College, Hospital, Jhansi. This study included ultrasonographic estimation of amniotic fluid volume by amniotic fluid index method.

The amniotic fluid index measurement was correlated with foetal heart rate and pregnancy outcome. The criteria for inclusion of cases in our study were as follows :

1. Singleton pregnancy.
2. Pregnancy with intact membrane with no history of leaking per vaginum.
3. Ultrasonographic measurement of amniotic fluid index in term gravid women i.e. between gestational period of 36 to 42 weeks.
4. Careful foetal heart rate monitoring during labour.

## INDICATIONS FOR ANTEPARTUM FOETAL SURVEILLANCE

1. Post dates.
2. Intrauterine growth retardation.
3. Hypertension.
4. Decreased foetal movements.

5. Antepartum haemorrhage.
6. Bad obstetrical history.
7. Gestational diabetes.
8. Severe anaemia.
9. Heart disease.
10. Miscellaneous i.e. Rh. negative.

The study was cross section and only a single ultrasonographic examination from each pregnancy was included.

ULTRASOUND EQUIPMENT AND TECHNIQUE

Obstetrical ultrasound at term is done in all subjects with Philips real time scann 3.5 mHZ linear transduces (with electronic callipers). Semiquantitative estimation of amniotic fluid volume was done as four quadrant technique described by Phelan et al (1987) known as Amniotic fluid index.

Currently available real time scanner contains the following components :

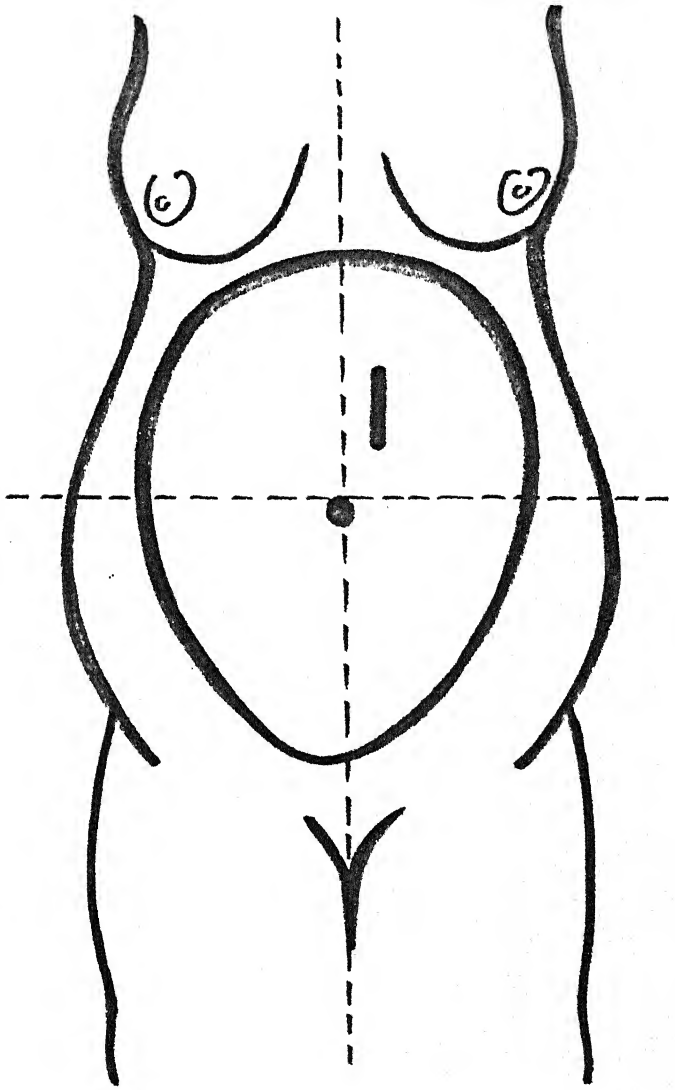
1. The transducer.
2. A scan convertor and monitor.
3. A control panel.
4. On screen calipers.
5. A mean of taking hard copy.

The transducer serves a dual function as both transmitter and receiver. Sound is transmitted in

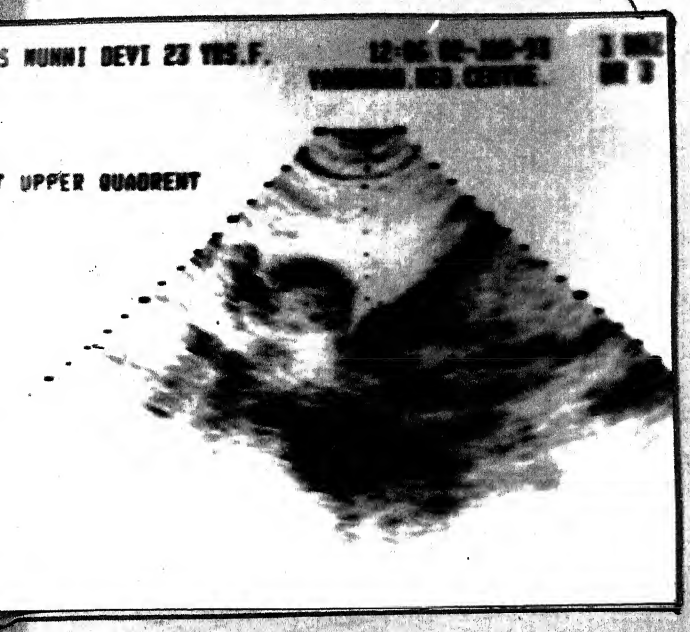
approximately 1000 short bursts and the transducer also function as a detector securing the returning echoes. It simultaneously manipulates the controls to optimally display the image.

Method of determination of amniotic fluid index

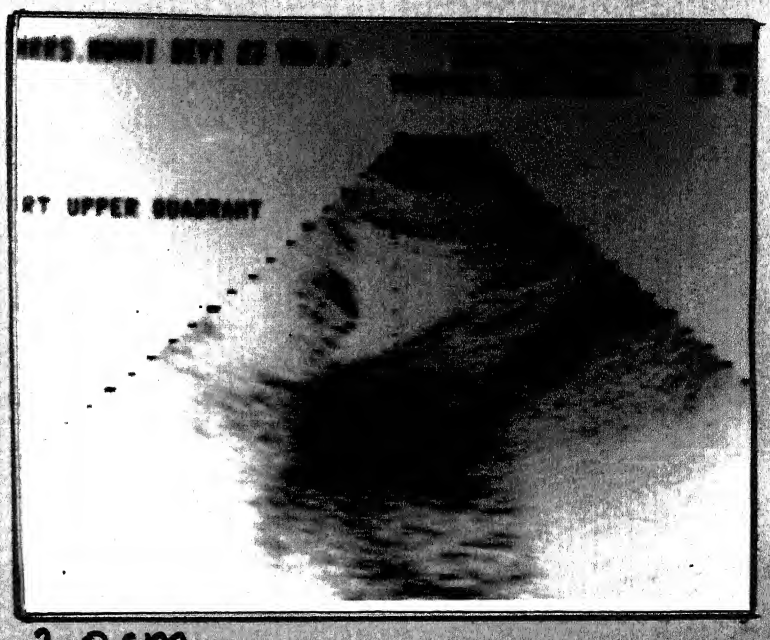
1. Patient positioned supine with full bladder.
2. Uterus viewed as four quadrant,land marks for the four quadrants of the maternal abdomen were used to divide the uterine cavity into 4 sections. The umbilicus divides it transversely into upper and lower halves and linear nigra divides into right and left halves.
3. Vertical depth of the largest clear amniotic fluid pocket is measured in centimeter.
4. Ultrasound transducer placed perpendicular to plain of the floor and aligned longitudinally with the patients supine.
5. Sum of four quadrant pocket depths denotes amniotic fluid index.
6. Brief appearance of cord or an extremity was ignored during measurement.
7. Pockets confluent with pockets in adjacent quadrants were avoided.
8. Amniotic fluid index 5 or less than 5 was taken as severe oligohydroamnios(Rutherford et al, 1987).



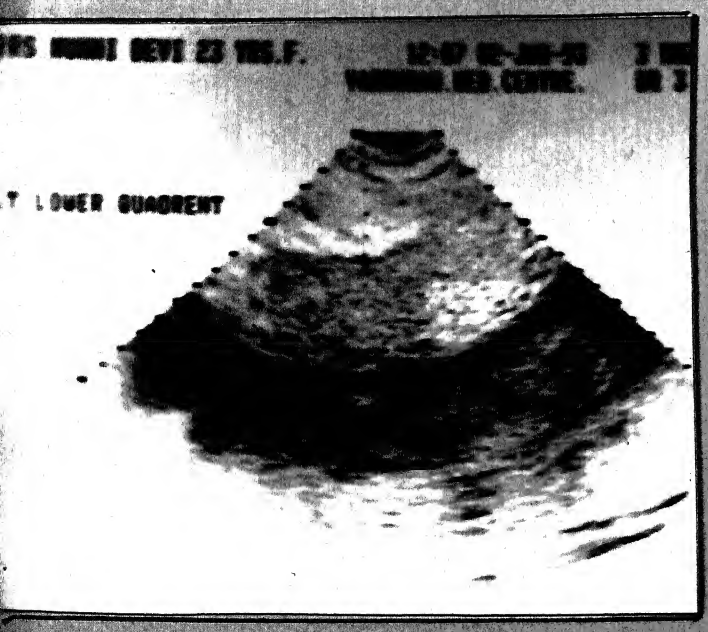
Diag. : The uterus is divided into four quadrants. The linea Nigra divides the uterus into right and left halves. The umbilicus divides the uterus in upper and lower halves.



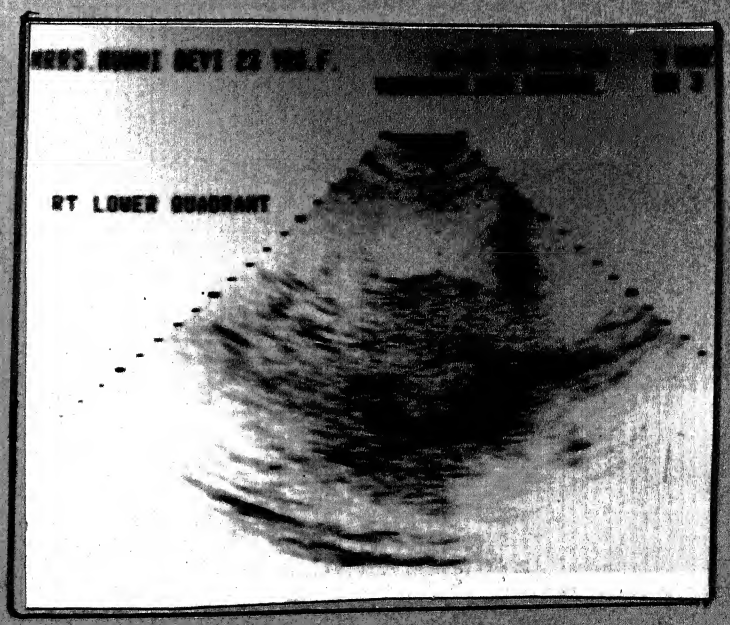

4.0 cm




2.0 cm




2.0 cm




1.0 cm

# Amniotic Fluid Index

AFI = 9.0 c

Other measurements like biparital diameter head circumference and abdominal circumference, femur length and head circumference/abd.circumference ratio were taken along with placental maturity grading to detect normal, Intrauterine growth retarded or post-mature foetus. Any congenital anomaly excluded for the sake of foetal well being.

Amniotic fluid estimation by ultrasound were compared with clinical recognition and amount of amniotic fluid drained (approximately) at the time of delivery.

CORRELATION OF AMNIOTIC FLUID VOLUME WITH FOETAL HEART RATE

Normal foetal heart rate is depicted by a rate of 120-160/min, which is uninfluenced by uterine contractions. Foetal heart rate was observed by stethoscope (in between contractions during labour). Foetal heart rate $<$120 i.e. bradycardia or more than 160/min i.e. tachycardia,irregular foetal heart rate persisting for more than 15 minutes was taken as a criteria for foetal distress.

In each patient amniotic fluid volume and foetal heart rate was correlated with foetal outcome.

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# O B S E R V A T I O N S

## OBSERVATION

In the present work 70 patients were studied by ultrasound at term pregnancy for amniotic fluid estimation by amniotic fluid index technique. The results were analysed as follows:

TABLE I

Reproducibility of amniotic fluid index (correlated with amniotic fluid volume at the time of delivery).

| Clinically | Amniotic fluid index | |
|---|---|---|
| | No. | Percentage |
| Corresponding | 64 | 91.43 |
| Not corresponding | 6 | 8.57 |
| TOTAL | 70 | 100.00 |

The amniotic fluid volume of 91.4% patients measured by AFI method were corresponding clinically with that of volume drained at delivery. Thus, the amniotic fluid index is a reliable and effective method for estimation of amniotic fluid volume.

TABLE II

Values of amniotic fluid index in term pregnancy, post dated pregnancy and IUGR cases.

| AFI (cm) | Term Pregnancy | | Post term pregnancy | | IUGR | | Total |
|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | |
| 00.0- 5.0 | 1 | 3.12 | 3 | 14.3 | 5 | 45.5 | 9+6*=15 |
| 5.1-10.0 | 10 | 31.25 | 15 | 71.4 | 6 | 54.5 | 31 |
| 10.1-15.0 | 12 | 37.50 | 3 | 14.3 | - | - | 15 |
| 15.1-20.0 | 9 | 28.15 | - | - | - | - | 9 |
| TOTAL (70-6=64) | 32 | 50.00 | 21 | 32.8 | 11 | 17.2 | 70 |

* 6 cases of IUD were excluded from the analysis.

This table demonstrates the amniotic fluid index in different subgroups of term, post term and IUGR pregnancies. In term pregnancy, study group of 50% cases mean amniotic fluid index was 12.6 with standard deviation of 3.6. Six cases of IUD were excluded from the analysis for the sake of accuracy. In 21% patients of post dated pregnancy subgroup mean amniotic fluid index was 7.6, indicating decrease in amniotic fluid volume in post term pregnancy. Among 11 cases(17.2%) IUGR subgroup mean amniotic fluid index was 7.0 showing tendency towards oligohydroamnios.

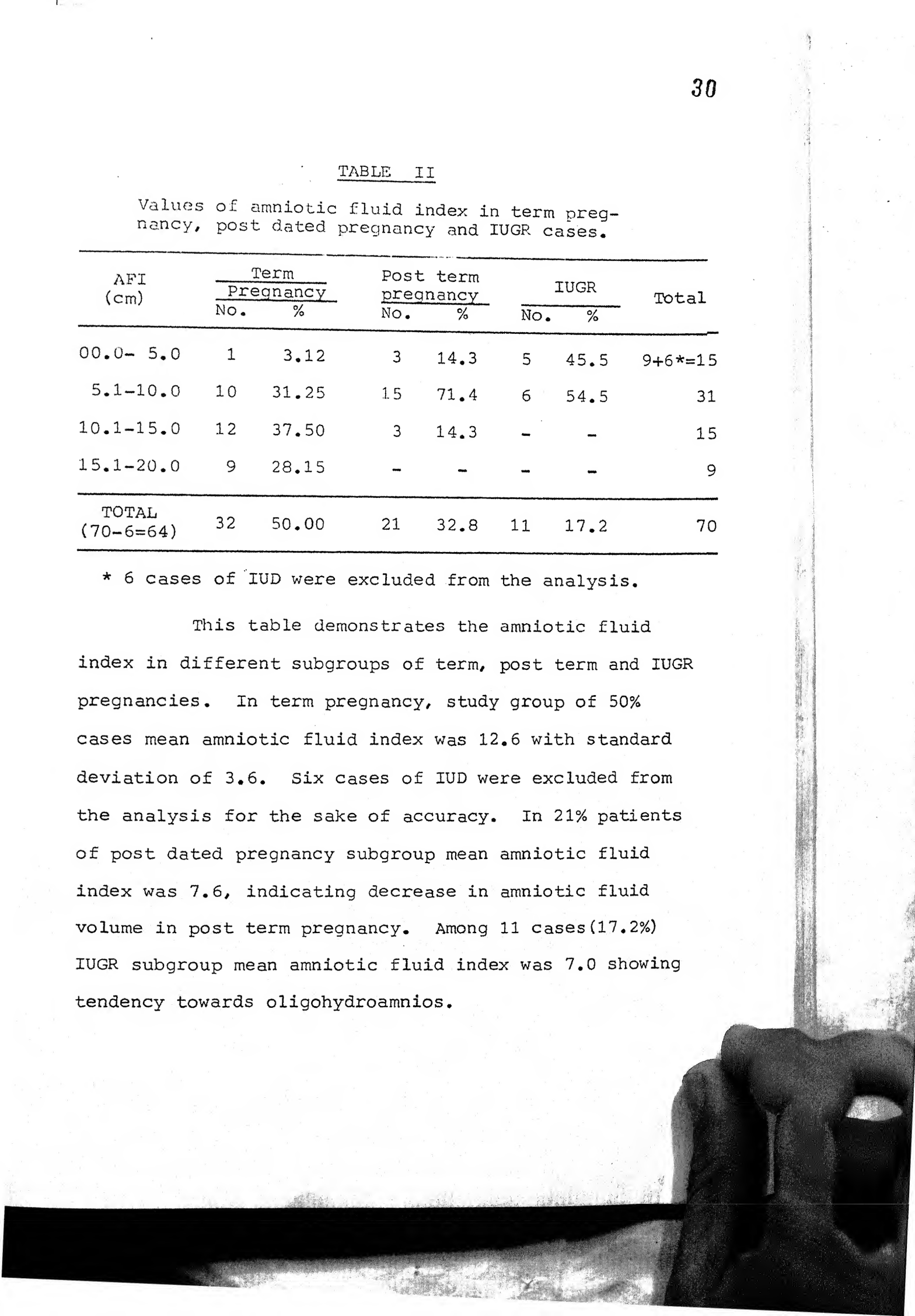

TABLE III

Oligohydroamnios : comparison of clinical and ultrasound diagnosis.

| Method | No.of cases | Percentage |
|---|---|---|
| Clinically | 7 | 10.00 |
| *AFI (⁄5.0 cm) | 15 | 21.43 |
| At delivery (Liquor) | 14 | 20.00 |

* False positive = 2 out of 15(13.3%)

False negative = 1 out of 15(6.67%)

Total patients = 70

There were 15 cases suspected to be having oligoamnios by AFI whereas clinically only 7 patients were suspected to have decreased liquor. At delivery only 14 patients showed oligoamnios. Thus the positive predictive value was 93% in comparison to 50% by clinical (symphysis fundal height) method. By AFI method false positive results were calculated to be 13.3% and false negative were 6.67%. Thus the accuracy and specificity of method came to 80% for the diagnosis of oligohydroamnios.

TABLE IV

Amniotic fluid index and fetal distress.

| AFI (cm) | Total No. | Foetal distress No. | Foetal distress % | IUD No. | IUD % |
|---|---|---|---|---|---|
| 00.0- 5.0 | 15 | 8 | 53.3 | 6 | 40.0 |
| 5.1-10.0 | 31 | 9 | 29.0 | - | - |
| 10.1-15.0 | 15 | 2 | 13.3 | - | - |
| 15.1-20.0 | 9 | 1 | 11.1 | - | - |
| TOTAL | 70 | 20 | | 6 | |

In the study group of oligohydroamnios 53.3% patients were diagnosed for foetal distress during labour. In AFI ⟨5 cm rate of foetal distress was calculated to be 53.3% with intrauterine death in 40% cases. The actual foetal distress was 89.9% in oligohydroamnios cases (by excluding IUD cases among oligohydroamnios) i.e. 8 out of 9 cases of oligoamnios reported foetal distress during labour. With increasing AFI the foetal distress rate was low. Only 12 out 55 cases reported foetal distress with AFI more than 5 cm giving incidence of 21.8% among normal group.

TABLE V

Amniotic fluid index and mode of delivery.

| Mode of delivery | Amniotic fluid index | | | |
|---|---|---|---|---|
| | Normal | | Oligoamnios | |
| | No. | % | No. | % |
| Total | 55 | 78.6 | 15 | 21.4 |
| 1. Vaginal | 41 | 74.5 | 5 | 33.3 |
| 2. Caesarian (Emergency) | 12 | 21.8 | 9 | 60.0 |
| 3. Elective caesarian | 2 | 3.6 | 1 | 6.6 |

Among normal AFI group caesarian section incidence was 21.8%. This high rate was due to higher rate of caesarian sections in our medical college due to refferal centre and high risk cases. The incidence of caesarian section was 60% in oligoamnios group. Two cases among normal group were operated electively due to transver lie and oephalopelvic disproportion, One case among oligo-amnios due to transverse lie with intrauterine death.

TABLE VI

Amniotic fluid index and birth asphyxia.

| APGAR SCORE | Amniotic fluid index | | | |
|---|---|---|---|---|
| | Normal | | Oligoamnios | |
| | No. | % | No. | % |
| Total cases | 55 | | 15 | |
| ⩾ 7 No birth asphyxia | 49 | 89.1 | 6 | 40.0 |
| ⩽ 7 birth asphyxia present. | 6 | 10.9 | 9 | 60.0 |

Birth asphyxia was present in 10.9% cases of normal group. In oligoamnios group 60% cases had APGAR score of less than seven. Actual asphyxia was present in 3 live born foetus out of nine and six foetus were born dead. Thus the incidence of birth asphyxia among oligoamnios cases calculated to be 33.3%. In ⩽5.0 cm AFI group one still birth occurred due to severe IUGR and meconium aspiration.

TABLE VII

Amniotic fluid index and perinatal mortality and morbidity.

| Perinatal | AFI normal(55) | | Oligoamnios(15) | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Mortality | 1 | 1.8 | 7 | 46.6 |
| Morbidity | 8 | 14.5 | 5 | 33.3 |

In normal AFI group mortality was 1(1.8%) as compared to 7(46.6%) in oligoamnios group in which 6 were intrauterine deaths occurred with in a week prior to ultrasound assessment and one was still birth. Perinatal morbidity was 33.3% in oligoamnios, about 2.3 times as compared to normal group. Combined perinatal mortality and morbidity incidence was 80% in oligoamnios as compared to 16.4% in normal group (about 5 times).

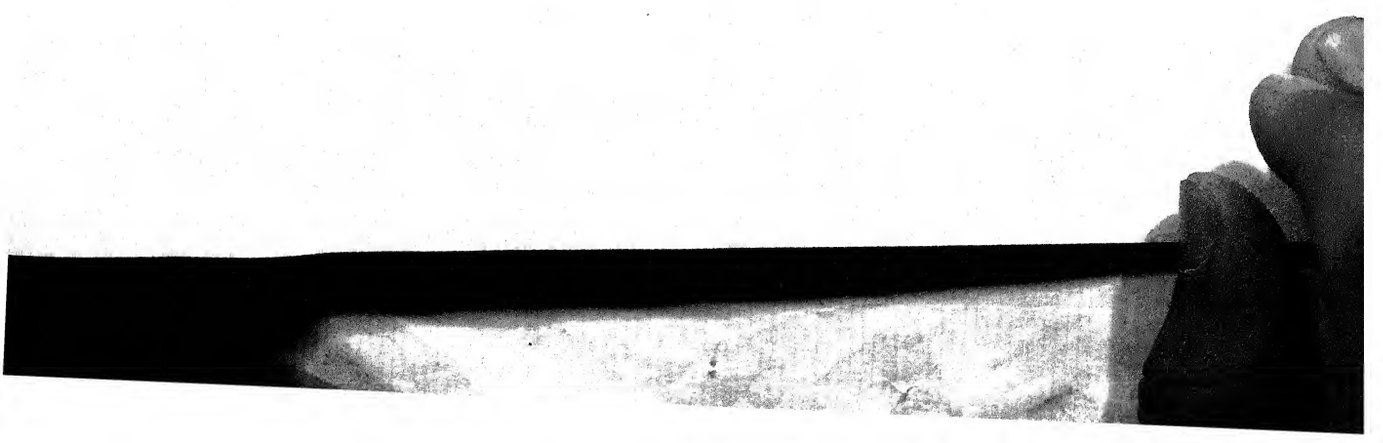

TABLE VIII

Amniotic fluid index with foetal growth and maturity.

| Growth | Amniotic fluid index | | | |
|---|---|---|---|---|
| | Normal | | Oligoamnios | |
| | No. | % | No. | % |
| Normal full term | 44 | 80.0 | 1 | 6.7 |
| IUGR | 6 | 10.9 | 5 | 33.3 |
| Post mature | 5 | 9.1 | 3 | 20.0 |
| Intrauterine death | - | - | 6 | 40.0 |
| TOTAL | 55 | 100.0 | 15 | 100.0 |

The babies were categorised into appropriate for gestational age as normal full term babies and small for date as IUGR. Incidence of IUGR was very high among oligoamnios cases(33.3%) when compared with those of normal liquor (10.9%). Among postmature babies 5 belongs to normal group (9.1%) and 3(20%) oligoamnios i.e. postmaturity is inversely proportional to amniotic fluid volume.

In intrauterine death, liquor was in extremely low range.

TABLE IX

Amniotic fluid index and post dated pregnancy.

| Amniotic fluid index(cm) | Weeks 40-41 No.(%) | 41.1-42 No.(%) | 42.1-43 No.(%) | Total No.(%) |
|---|---|---|---|---|
| 00.0- 5.0 | - | 1(4.8) | 2(9.5) | 3(14.3) |
| 5.1-10.0 | 5(23.8) | 7(33.3) | 3(14.3) | 15(69.0) |
| 10.1-15.0 | 3(14.3) | - | - | 3 (14.3) |
| 15.1-20.0 | - | - | - | - |

Total post dated pregnancy = 21(100%).

Among 21 post dated pregnancies in this study only 8(38.1%) foetus were diagnosed as postmature clinically after birth and all these pregnant women had AFI less than 10 cm. 14.3% cases had AFI less than 5 cm, 69% had between 5-10 cm and 14.3% had AFI between 10-15 cm.

The mean AFI was in post term pregnancy.

40.0-41 weeks - 8.4 cm

41.1-42 weeks - 7.5 cm

42.1-43 weeks - 6.7 cm

These results showed gradual decline in amniotic fluid volume after 40 weeks pregnancy. The decline is calculated about 10% per week.

TABLE X

Correlation of AFI and placental grading in post dated pregnancy.

| Gestational age(weeks) | No.of cases | Placental grading II | Placental grading III | AFI mean (cm) |
|---|---|---|---|---|
| 40 - 42 | 16 | 9 | 7 | 8.0 |
| 7 42 | 5 | 2 | 3 | 6.7 |
| TOTAL | 21 | 11 | 10 | |

Ultrasonographic placental grading was done in post dated pregnancies. Immature placenta (grade 0 or 1) was not found after 40th week of gestational age. Grade II and III placenta were found with similar frequency. But there was significantly decreased amniotic fluid volume with advancing pregnancy.

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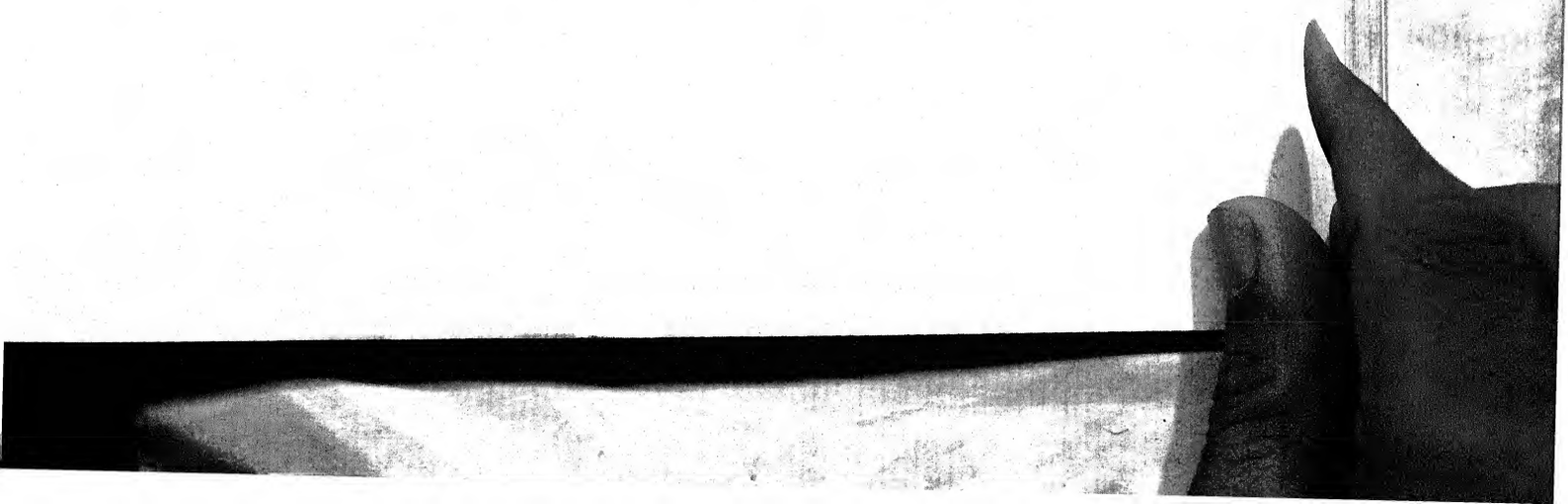
# D I S C U S S I O N



# DISCUSSION

Measurement of amniotic fluid volume assists the obstetrician to assess the risk of the fetus because amniotic fluid volume has been proved to be an indirect measure of feto-placental function for example, hypoxemia of fetal lungs has been shown to decrease renal perfusion which will result in reduced urine output and reduction of amniotic fluid volume.

Historically amniotic fluid has been measured initially using amniocentesis and dye dilution techniques. But currently ultrasonography has been proved to be a safe and noninvasive method of amniotic fluid volume estimation. In this study, amniotic fluid index method was used to detect amniotic fluid volume. Amniotic fluid index was found to be reliable method as 91.4% of cases were corresponding with the liquor drained during labour.

## MEAN AMNIOTIC FLUID INDEX

In normal term pregnancy group of this study mean amniotic fluid index was 12.6±3.6 (Table I) in comparison to 12.9±4.6 calculated by Phelan et al(1987) and 11.5±4.7 calculated by Moore (1990). Thus our study findings are corresponding with the previous ones. Mean amniotic fluid index in post dated pregnancy was

7.6 (range 3.0-13.0) in our study. Previously Moore (1990) reported mean AFI in post dated pregnancy as 10.8 cm (range 6.7-17.4 cm) and Grubb et al (1992) reported mean AFI as 9.1 cm (range 4.1-18.7). Phelan (1987) and Moore (1990) reported the decrease in amniotic fluid volume after completion of 37 gestational weeks. Moore reported 12% decrease per week in the amniotic fluid index in post dated period. In our study there was significant decrease in AFV in post dated pregnancy with 10% decline per week (Table IX).

OLIGOAMNIOS

Rutherford and Phelan et al (1987) gave criteria of AFI less than 5 cm as oligohydroamnios. In their study of 330 cases 27 had oligoamnios (8%). In our study incidence of oligoamnios was 21.4%(15 out of 70). In this group we also included the cases with intrauterine death. Higher rate of oligoamnios in this study was due to more cases of postdated pregnancy (table II). Positive predictive value for oligoamnios was calculated as 93% but the accuracy and specificity was only 80%. Same predictive value was found in a study of AFI in Manipal (Pratak Kumar et al, 1991).

OLIGOAMNIOS AND FOETAL DISTRESS (TABLE IV)

Rutherford et al (1987) studied the incidence of fetal distress in oligoamnios (by AFI method). It

was 56% in comparison to 21% among normal group. In our study rate of fetal distress was 89.9%(excluding IUD cases) in oligoamnios group, and 21.8% among normal group. Thus there is significant increase in rate of foetal distress with lesser amniotic fluid index. Sarno (1990) also described the correlation between oligoamnios abnormal fetal heart rate. He reported that variable deceleration in early labour were associated with oligoamnios in 43.8% of patients. Robson (1992) also reported higher incidence of fetal heart rate abnormalities during labour with low amniotic fluid index (64% : 20%). Thus oligohydro-amnios diagnosed in antenatal period predicts the risk of neonatal compromises in subsequent labour and adverse outcomes.

AFI AND MODE OF DELIVERY (TABLE V)

In present study caesarian section incidence was 21.8% in normal AFI group and 60% among oligoamnios. Elective caesarian sections were excluded from the calculation. Rutherford et al (1987) reported 44.4% incidence of caesarian section in oligoamnios and 26.7% in normal group. Grubb et al (1992) also reported 64% incidence of caesarian section in oligoamnios group and 21% in normal group. Thus we concluded that need

for operative interventions is increased when oligo-amnios is present. In intrapartum study of AFI, Sarno (1990) found significant increase in caesarian section for foetal distress in oligoamnios (11.9% Vs 2.5% in normal group).

AMNIOTIC FLUID INDEX AND BIRTH ASPHYXIA (TABLE VI)

Rutherford et al (1987) studied the incidence of 29.6% of birth asphyxia in oligoamnios as compared to 12.87% in normal volume. Sarno (1990) reported birth asphyxia in oligoamnios as 26.2% and in normal AFI as 12.7%. In our study birth asphyxia was present in 10.9% cases of normal group and 33.3% cases of oligoamnios group. Thus amniotic fluid volume is inversely proportional to birth asphyxia (APGAR Score /7 at 1 min) and this is a effective discriminatory test to be used in pregnancy evaluation in relation to fetal outcome.

There was increased incidence of perinatal mortality and morbidity in oligoamnios group (46.6%) and 33%) as compared to normal group (1.8% and 14.5%). Phelan and Rutherford (1987), Sarno (1990) and Shmoy (1990) reported increased incidence of perinatal morbidity in oligoamnios cases. Thus amniotic fluid index is an appropriate predictor of perinatal outcome (Table VII).

AMNIOTIC FLUID INDEX AND IUGR

Incidence of IUGR was very high among oligohydroamnios cases (33.3%) as compared to those with normal liquor (10.9%). Manning et al (1981) found that qualitative AFV less than 1 cm was associated with IUGR fetuses in 89.9% cases. This very high incidence of IUGR in Manning et al (1981) study was due to his restrictive criteria of 1 cm largest fluid pocket. Chamberlain et al (1984) reported that in cases with AFV pocket $\angle$2 cm, incidence of IUGR was 38.6%. Thus there is a definite direct relationship between IUGR and oligoamnios. But Hadlock (1984) reported that semiquantitative estimation of amniotic fluid as a sole criteria for prediction of IUGR is associated with 96% falsely negative tests. In our study 45.5% IUGR cases reported oligoamnios and 54.5% normal AFV. Thus oligoamnios as a sole criteria for prediction of IUGR is not suggested according to present study. Other ultrasound measurements should also be judged for better diagnosis (Table VIII).

AMNIOTIC FLUID INDEX AND POST DATED PREGNANCY

With the post term pregnancy, amniotic fluid index decreases and decreases in AFV is associated with increased fetal risk. In present study advanced

post maturity was found in 8 foetuses (total post dated pregnancy were 21). Thus the incidence of advanced post maturity was 38.1%. Moya F (1985) reported the incidence of advanced post maturity among post dated pregnancy as 12.9%.

In advanced postmaturity cases placental grading was also done which were II and III grade with similar frequency in our study. But the amniotic fluid volume was recorded in lower range amongst them. Thus oligohydroamnios is a better predictor of post-maturity than the placental grading. Same results were evaluated by Moya F (1985).

Oligoamnios has been recognised as an abnormal sign in biophysical profile. This predicts poor fetal outcome and usually associated with IUGR and post dated pregnancy.

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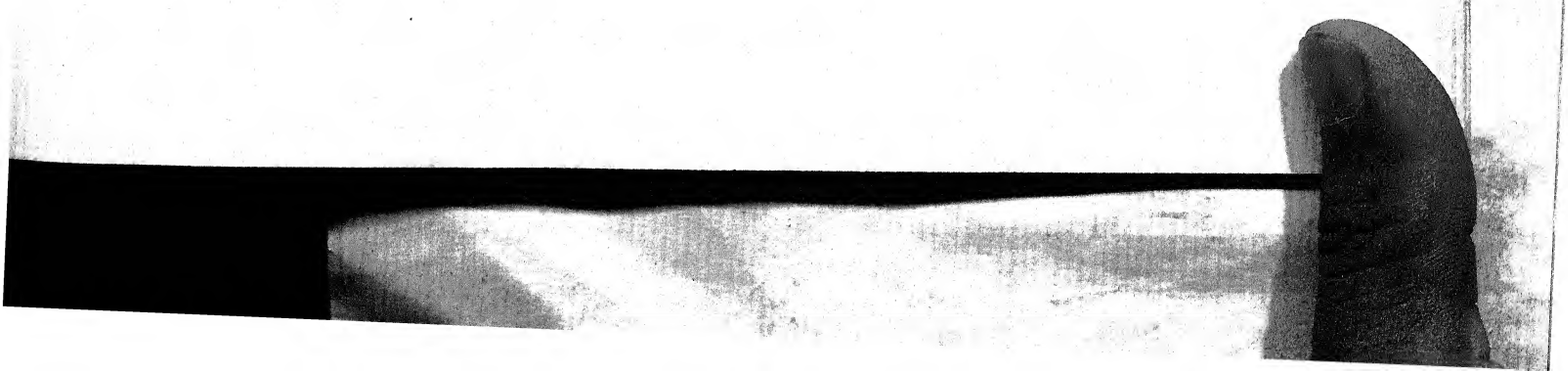
# SUMMARY AND CONCLUSION



## SUMMARY AND CONCLUSION

- Seventy antenatal cases were studied by ultrasonography for amniotic fluid volume estimation by amniotic fluid index method.
- Amniotic fluid index is a reliable method for amniotic fluid estimation and for diagnosing oligohydroamnios cases for which it has predictive value of 93%.
- Mean amniotic fluid index in normal term pregnancy was $12.6 \pm 3.6$ and there was significant gradual decrease in AFI in post term pregnancy as 10% per week.
- There was increase incidence of IUGR among oligoamnios group (33.3%) as compared to normal group (10.9%).
- There was significant increase in foetal distress (53.3%) in oligohydroamnios cases and increased incidence of birth asphyxia (33.3%) whereas in normal group fetal distress was 21.8% and birth asphyxia also in 21.8% cases.
- Perinatal mortality and morbidity was more in cases of oligoamnios (46.6%, 33.3%).

- Rate of caesarian section was much higher among oligoamnios group (60%) as compared to normal group (21.8%).
- In IUD cases amniotic fluid index was very low (average 2.6). Thus AFI in extremely low range is an omnious sign.
- In post maturity cases amniotic fluid index is a better predictor in comparison to placental grading by ultrasound.

Conclusion

Amniotic fluid index is simple, reliable, requires little time and semiquantitative estimate of amniotic fluid volume by ultrasound. This four quadrant technique was evaluated in relationship of fetal heart rate, meconium staining, birth asphyxia(APGAR $\angle$7) and perinatal mortality and morbidity. The study was done on 70 patients of term pregnancy. There was increased incidence of fetal distress, fetal asphyxia, perinatal mortality, morbidity along with increased incidence of caesarian sections in cases of oligoamnios. Thus reduced AFI is directly proportional to the poor fetal outcome. There was increased incidence of IUGR and postmaturity in oligohydroamnios cases.

Thus amniotic fluid index is a reliable method for antepartum foetal surveillance.

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# B I B L I O G R A P H Y


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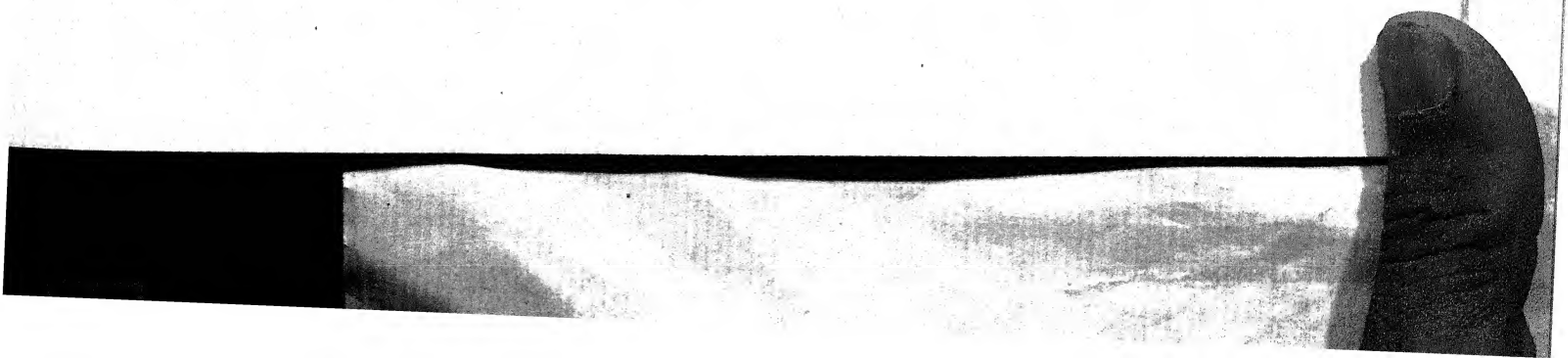
# M A S T E R  C H A R T



# MASTER CHART

| Sl. No. | Name | Age (yrs.) | GPA | Gestation (week) | Fundal height (cm) | Clinical diagnosis | AFI | Foetal heart |
|---|---|---|---|---|---|---|---|---|
| NORMAL TERM PREGNANCY | | | | | | | | |
| 1. | Asha Singh | 27 | G2P1Ao | 39 | 36 | FTP with loss of foetal movement | 15.4 | Bradycardia |
| 2. | Angoori-1 | 33 | G3P2Ao | 38 | 30 | FTP with ? IUGR | 13.4 | Regular |
| 3. | Shanu Devi | 28 | G4P3Ao | 38 | 34 | FTP with P.E. toxemia | 9.8 | Regular |
| 4. | Pushpa | 22 | G2P1Ao | 38 | 36 | FTP with gestational diabetes | 8.4 | Regular |
| 5. | Naseema | 25 | G2P1Ao | 39 | 36 | FTP with severe anaemia | 10.8 | Regular |
| 6. | Amana | 20 | G1PoAo | 38 | 36 | FTP with mistaken dates | 9.8 | Regular |
| 7. | Shaira | 28 | G2P1Ao | 38 | 34 | FTP with severe anaemia | 9.8 | Regular |
| 8. | Radha | 22 | G1PoAo | 38 | 36 | FTP with breech Presentation | 16.4 | Regular |
| 9. | Meena | 30 | G6P5Ao | 40 | 36 | -Rh -ve with BOH | 16.8 | Regular |
| 10. | Boonda | 32 | G7P6Ao | 37 | 34 | FTP with BOH with oligoamnios | 6.3 | Bradycardia |
| 12. | Mehrabi | 28 | G4P3Ao | 38 | 36 | FTP with APH | 14.2 | Tachycardia |
| 13. | Angoori-2 | 32 | G6P5Ao | 39 | 36 | FTP with Oligo-amnios | 9.4 | Regular |
| 11. | Ranno | 25 | G3P2Ao | 38 | 36 | Full term ? Post mature. | 17.0 | Regular |
| 14. | Niranjana | 20 | G1PoAo | 40 | 36 | Breech Presentation | 9.9 | Irregular |
| 15. | Kusum | 22 | G2P1Ao | 38 | 36 | Prev.LSCS C̄ Rh -ve | 12.8 | Irregular |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 16. | Geeta | 22 | G2PoA1 | 39 | 36 | Toxemia | 9.0 | Regular |
| 17. | Ratan | 30 | G4P3Ao | 38 | 36 | Prev LSCS for fetus distress | 15.0 | Regular |
| 18. | Baijanti | 20 | G1PoAo | 39 | 36 | Excessice fetal movements | 8.4 | Regular |
| 19. | Meena | 20 | G1PoAo | 40 | 36 | FTP with PET | 16.4 | Regular |
| 20. | Girja | 30 | G4P2A1 | 39 | 36 | FTP C̄ gestational diabetes | 18.0 | Regular |
| 21. | Tulsa | 32 | G4P2A1 | 40 | 38 | FTP with Anaemia | 14.0 | Regular |
| 22. | Sadhna | 20 | G1PoAo | 39 | 36 | FTP with APH | 8.8 | Bradycardia |
| 23. | Anita | 23 | G1PoAo | 37 | 35 | FTP with IUGR | 8.2 | Regular |
| 24. | Shushila | 25 | G2P1Ao | 38 | 36 | Full term C̄ severe anaemia | 14.2 | Regular |
| 25. | Asha Singh | 20 | G2P1Ao | 38 | 36 | Loss of fetal movements | 15.8 | Regular |
| 26. | Guddi | 20 | G1PoAo | 39 | 35 | Severe anaemia (NPOL) | 13.8 | Irregular |
| 27. | Munni Devi | 20 | G1 | 38 | 36 | Loss of foetal movements | 13.6 | Regular |
| 28. | Raj Batriya | 18 | G1 | 37 | 34 | Toxemia | 18.0 | Regular |
| 29. | Sunaina | 20 | G1 | 38 | 36 | Rh -ve C̄ transverse lie | 12.9 | Regular |
| 30. | Shanti Devi | 32 | G4P3Ao | 39 | 36 | FTP with BOH | 15.4 | Regular |
| 31. | Abhilasha | 20 | G2P1A0 | 38 | 36 | Full term C̄ oligoamnios | 4.0 | Bradycardia |
| 32. | Shamsheer | 23 | G2P1Ao | 38 | 34 | Full term | 14.0 | Regular |

POST DATED PREGNANCY

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1. | Mamta Jain | 20 | G1 | 41 | 38 | Post dated | 6.8 | Regular |
| 2. | Mithlesh | 25 | G4P3Ao | 42.2 | 37 | Post dated | 8.0 | Regular |
| 3. | Sunita | 22 | G1 | 41 | 36 | Post dated | 5.2 | Tachycardia |
| 4. | Namita | 29 | G1 | 42 | 38 | Post dated C̄ ↑ foetal movement. | 4.2 | Tachycardia |
| 5. | Himali Devi | 28 | G1 | 42 | 38 | Post dated | 7.2 | Regular |
| 6. | Mithlesh | 27 | G4P3Ao | 40.5 | 36 | Post dated | 12.0 | Regular |
| 7. | Sunita | 22 | G1 | 42 | 36 | Post dated | 8.2 | Bradycardia |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8. | Asha | 25 | G1 | 43 | 36 | Post dated | 7.6 | Irregular |
| 9. | Basanti devi | 25 | G2P1Ao | 41 | 39 | Postdated with Previous LSCS | 05.8 | Regular |
| 10. | SuShma | 18 | G1 | 41 | 36 | Post dated | 13.0 | Regular |
| 11. | Kastoori | 35 | G6P5Ao | 42 | 37 | post dated | 10.0 | Regular |
| 12. | Satyabhama | 28 | G2P1Ao | 41.5 | 38 | Post dated | 5.2 | Regular |
| 13. | Manju | 21 | G1 | 42.4 | 40 | Post dated | 3.0 | Irregular + Tachycardia |
| 14. | Ram Murti | 25 | G2P1Ao | 41.6 | 36 | Post dated | 4.2 | Regular |
| 15. | Sadhna | 24 | G3P2Ao | 41 | 38 | Post dated | 6.8 | Irregular |
| 16. | Raj Kumari | 22 | G1PoAo | 41.4 | 38 | Post dated | 6.6 | Regular |
| 17. | Gaura | 30 | G7P5A1 | 40.6 | 37 | Post dated | 11.4 | Regular |
| 18. | Saroj | 28 | G3P2Ao | 41.0 | 36 | Post dated | 6.2 | Regular |
| 19. | Vishnu devi | 20 | G1 | 42.2 | 38 | With toxemia | 10.0 | Tachycardia |
| 20. | Ram Kali | 30 | G3P2Ao | 43 | 40 | Post dated | 4.8 | Bradycardia |
| 21. | Ranno | 22 | G3P2Ao | 41.5 | 40 | Post dated | 9.4 | Regular |
| INTRAUTERINE DEATH | | | | | | | | |
| 1. | Sapna | 25 | G3P1A1 | 39 | 36 | Transverse lie with loss of fetal. movement | 3.3 | Absent |
| 2. | Geeta | 32 | G5P4Ao | 38 | 34 | Loss of fetal movement | 4.0 | Absent |
| 3. | Nirmala | 20 | G1PoAo | 37 | 30 | FTP with IUD | 1.2 | Absent |
| 4. | Archana | 23 | G2P1Ao | 38 | 32 | Severe anaemia | 3.2 | Absent |
| 5. | Suman | 28 | G3P2Ao | 37 | 28 | Loss of fetal movement | 2.0 | Absent |
| 6. | 25Rano | 25 | G1 | 37 | 34 | Severe anaemia | 2.2 | Absent |

INTRAUTERINE GROWTH RETARDATION

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1. | Kalawati | 26 | G2P1Ao | 38 | 36 | FTP with IUGR | 5.0 | Bradycardia |
| 2. | Shakuntala | 21 | G2 | 37 | 34 | Mistaken dates ? | 4.2 | Regular |
| 3. | Rano | 20 | G1 | 39 | 34 | Loss of fetal movement | 4.0 | Irregular |
| 4. | Shobhna | 24 | G2P1Ao | 40 | 34 | Severe anaemia | 5.0 | Bradycardia |
| 5. | Meena | 28 | G3P2Ao | 38 | 34 | Severe anaemia | 4.6 | Regular |
| 6. | Pushpa | 22 | G2P1Ao | 38 | 34 | Loss of fetal movement | 9.4 | Bradycardia |
| 7. | Helma | 30 | G2PoAo | 38 | 36 | IUGR | 1.5 | Bradycardia |
| 8. | Nirmala | 20 | G1PoAo | 38.5 | 36 | Oligoamnios | 9.8 | Regular |
| 9. | Harku | 23 | G2P1Ao | 38 | 34 | FTP with IUGR | 10.0 | Regular |
| 10. | Shashi | 28 | G3P2Ao | 38 | 34 | FTP | 9.4 | Tachycardia |
| 11. | Malti Jain | 22 | G1 | 38 | 34 | Severe anaemia | 9.8 | Regular |

| Sl. No. | Meconium | Mode of delivery | APGAR (1 min) | Weight of baby (kg) | New born assessment | Perinatal mortality & morbidity | Placenta grade |
|---|---|---|---|---|---|---|---|
| 1. | +2 | Vaginal | 5 | 2.5 | Full term normal | - | I |
| 2. | - | Vaginal | 8 | 2.0 | Premature 35 weeks | - | 0 |
| 3. | - | Vaginal | 8 | 2.5 | Full term normal | - | II |
| 4. | +1 | Vaginal | 7 | 2.7 | -do- | - | II |
| 5. | - | Vaginal | 8 | 2.8 | -do- | - | II |
| 6. | - | Vaginal | 8 | 2.8 | -do- | - | II |
| 7. | - | Vaginal | 8 | 2.7 | -do- | - | II |
| 8. | +2 | Vaginal | 8 | 3.2 | -do- | - | II |
| 9. | - | Vaginal | 9 | 3.0 | -do- | - | II |
| 10. | - | Caesarian | 8 | 2.5 | -do- | + | III |
| 11. | - | Vaginal | 8 | 3.9 | Full term normal macrosomia | - | II |
| 12. | +2 | Caesarian | 8 | 3.0 | Full term normal | - | I |
| 13. | - | Vaginal | 7 | 2.5 | -do- | - | II |
| 14. | +3 | Caesarian | 7 | 3.5 | -do- | - | II |
| 15. | +1 | Caesarian | 8 | 3.2 | -do- | - | II |
| 16. | - | Vaginal | 7 | 2.6 | -do- | - | II |
| 17. | - | Vaginal | 8 | 3.8 | -do- | - | II |
| 18. | - | Vaginal | 8 | 3.2 | -do- | - | III |
| 19. | - | Vaginal | 8 | 2.8 | -do- | - | III |
| 20. | - | Vaginal | 8 | 3.4 | -do- | - | III |
| 21. | - | Vaginal | 8 | 3.2 | -do- | - | II |
| 22. | +1 | Caesarian | 6 | 2.6 | -do- | + | II |
| 23. | - | Vaginal | 8 | 2.3 | Premature 34-35 weeks | + | I |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24. | - | Vaginal | 8 | 2.5 | Full term normal | - | I |
| 25. | - | Vaginal | 9 | 2.6 | -do- | - | II |
| 26. | +2 | Caesarian | 8 | 2.7 | -do- | + | II |
| 27. | - | Vaginal | 8 | 2.8 | -do- | - | II |
| 28. | - | Vaginal | 9 | 2.9 | -do- | - | II |
| 29. | - | Caesarian elective | 8 | 2.6 | -do- | - | II |
| 30. | - | Vaginal | 9 | 3.1 | -do- | - | II |
| 31. | - | Caesarian | 8 | 2.8 | -do- | - | II |
| 32. | - | Vaginal | 8 | 2.5 | -do- | - | I |
| POST DATED PREGNANCY | | | | | | | |
| 1. | +1 | Vaginal | 8 | 3.6 | Full term normal | - | III |
| 2. | - | Vaginal | 8 | 3.8 | Post mature | - | II |
| 3. | +2 | Caesarian | 7 | 3.8 | -do- | + | II |
| 4. | +2 | Caesarian | 8 | 3.2 | -do- | + | III |
| 5. | - | Vaginal | 8 | 2.8 | Full term normal | - | III |
| 6. | - | Vaginal | 8 | 3.8 | 41 weeks fetus | - | III |
| 7. | +1 | Caesarian | 8 | 4.0 | Post mature | - | II |
| 8. | +2 | Caesarian | 7 | 4.2 | -do- | + | III |
| 9. | - | Caesarian El.(CPD) | 9 | 4.2 | -do- | - | III |
| 10. | - | Vaginal | 9 | 3.0 | Full term | - | II |
| 11. | - | Vaginal | 8 | 3.0 | -do- | - | II |
| 12. | - | Vaginal | 8 | 2.8 | -do- | - | III |
| 13. | +1 | Caesarian | 6 | 4.0 | Post mature | + | III |
| 14. | - | Vaginal | 9 | 2.6 | Full term | + | II |
| 15. | - | Caesarian | 8 | 3.0 | -do- | - | II |
| 16. | - | Vaginal | 8 | 3.4 | Full term 41 weeks | - | II |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 17. | - | Vaginal | 9 | 3.7 | Full term 41 weeks | - | III |
| 18. | - | Vaginal | 8 | 3.5 | -do- | - | II |
| 19. | +2 | Caesarian | 5 | 3.0 | -do- | Died within 1 week | II |
| 20. | +1 | Caesarian | 5 | 3.0 | Post mature | Meconium aspiration | III |
| 21. | - | Vaginal | 9 | 3.4 | Full term | - | III |
| INTRAUTERINE DEATH | | | | | | | |
| 1. | - | Caesarian elective | 0 | 2.3 | IUD within 48 hours | Mortality | II |
| 2. | - | Vaginal | 0 | 2.6 | " " 24 " | -do- | III |
| 3. | - | Vaginal | 0 | 2.0 | " " 1 week | -do- | II |
| 4. | - | Vaginal | 0 | 2.5 | " " 1 " | -do- | III |
| 5. | - | Vaginal | 0 | 1.4 | Old IUD | -do- | III |
| 6. | - | Vaginal | 0 | 2.6 | IUD within 24 hours | -do- | II |
| INTRAUTERINE GROWTH RETARDATION | | | | | | | |
| 1. | +2 | Caesarian | 6 | 2.0 | IUGR | Severe iterus | II |
| 2. | +3 | Caesarian | 0 | 2.0 | Still birth IUGR | Mortality | II |
| 3. | +1 | Caesarian | 8 | 2.6 | IUGR | -do- | II |
| 4. | +1 | Caesarian | 8 | 2.6 | IUGR | -do- | II |
| 5. | - | Vaginal | 9 | 2.2 | IUGR | -do- | II |
| 6. | +1 | Vaginal | 6 | 2.2 | IUGR | Septicemia | II |
| 7. | +2 | Caesarian | 8 | 2.3 | IUGR | Fever U.O. | II |
| 8. | - | Vaginal | 8 | 2.4 | IUGR | - | II |
| 9. | - | Vaginal | 6 | 2.5 | IUGR | - | II |
| 10. | +3 | Caesarian | 4 | 2.1 | IUGR | Meconium aspiration | III |
| 11. | - | Vaginal | 7 | 2.5 | IUGR | - | II |

# A P P E N D I X

APPENDIX -

WORKING PROFORMA

AMNIOTIC FLUID INDEX

Case No. ___

Name : W/o :

Age :

Address :

Gravida Parity Abortion

Mode of previous deliveries :

1. 2.

3. 4.

L.M.P.

Gestational age in weeks :

P/A : FH in weeks :

FH in cms :

FHS

Presentation:

Abdominal circumference:

ULTRASOUND

Gestational age FL :

B.P.D. HC/AC:

A.C.

IUGR

Placental grading

Amniotic fluid index

Congenital Anomaly

Foetal distress : +/-

Mode of Delivery :

Out come : Baby APGAR at 1 min & 5 min :

Perinatal outcome :

Inference :

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